Amendments to the Specification

Please replace the title with the following amended title:

~~WAVEGUIDE TYPE OPTICAL ELEMENT, INTEGRATED OPTICAL WAVEGUIDE TYPE ELEMENT USING WAVEGUIDE TYPE OPTICAL ELEMENT, AND~~ A METHOD OF MANUFACTURING WAVEGUIDE TYPE OPTICAL ELEMENT AND INTEGRATED OPTICAL WAVEGUIDE TYPE ELEMENT USING WAVEGUIDE TYPE OPTICAL ELEMENT

Please replace the paragraph beginning on page 1, line 34 with the following amended paragraph:

Below, a ~~detail~~ detailed explanation will be described referring to Figs. 10A – 10D ~~Fig.10~~.

Please replace the paragraph beginning on page 2, line 16 with the following amended paragraph:

As shown in Fig.10B, the multi quantum well layers 4, the light absorption layer 5, and the first clad layer 6 are strip-like ~~stripy~~ etched by using an insulation film mask 7.

Please replace the paragraph beginning on page 6, line 28 with the following amended paragraph:

As shown in Fig. 1A, a light absorption layer 12 is formed on an n type InP substrate 11. The light absorption layer 12 is formed by quaternary mixed crystal. An ~~undope~~ undoped InP layer 13 is formed on the light absorption layer 12. Thickness of the ~~undope~~ undoped InP layer 13 is 10nm to 200nm. At this time, in a case where quantum containment stark effect (QCSE) is used, the light absorption layer 12 is a multi quantum well structure(MQW structure).

Please replace the paragraph beginning on page 7, line 3 with the following amended paragraph:

As shown in Fig. 1B, an insulation film mask 14 is formed on the ~~undope~~ undoped InP layer 13 by photolithography and etching. Width of an aperture of the insulation film mask 14 is approximately ~~approximate~~ 1μm to 3μm.

Please replace the paragraph beginning on page 7, line 8 with the following amended paragraph:

As shown in Fig.1C, the ~~undope~~ undoped InP layer 13 is etch-removed using the insulation layer 14 until the light absorption layer 12 is exposed. At this time, since the light absorption layer 12 is formed by quaternary ~~quaternion~~ mixed crystal, the light absorption layer 12 can be used as an etching stop layer. An etching removed area is

consistent with an area to make a ridge part of the waveguide type optical element.

Please replace the paragraph beginning on page 7, line 16 with the following amended paragraph:

As shown in Fig.1D, a p type InP clad layer 15 is formed so as to cover the exposed light absorption layer 12 and the undoped ~~undope~~ InP layer 13. Next, a p type InGaAs contact layer 16 is formed on the p type InP clad layer 15.

Please replace the paragraph beginning on page 7, line 21 with the following amended paragraph:

As aforementioned above, when the light absorption layer 12 and the p type InP clad layer 15 are MOVPE grown, impurity is not added at a time where the light absorption layer 12 is grown and p type impurity is added at a time where the p type InP clad layer 15 is grown. Zn is chosen as a material added as p type impurity. At this time, amount to diffuse Zn on the absorption layer is controlled by controlling carrier density of Zn. Actually, the layers are grown at 600°C to 700°C in MOVPE growth. Time to grow the p type InP clad layer 15 depends on a growth speed. Usually, since the 1μm or more p type InP clad layer 15 is grown, growth of the p type InP clad layer 15 takes 20 minutes ~~minuitues~~ to 60 minutes ~~minuitues~~. Diffusion of Zn is determined by carrier density, temperature and time. A growth condition is controlled in order that Zn is diffused on the light absorption layer 12 by controlling those values. Amount to

diffuse Zn is amount to diffuse Zn on a surface of the light absorption layer 12 and the p type InP clad layer 15. It is necessary to control amount to diffuse amount so that the light absorption layer 12 is not perforated.

Please replace the paragraph beginning on page 8, line 12 with the following amended paragraph:

As shown in Fig.2B, the p type InP clad layer 15 and p type InGaAs contact layer 16 at the side of the area to make the ridge part are etched using the insulation film mask 17 until the light absorption layer 12 is exposed. Concretely, the p type InP clad layer 13 is dry-etched up to a portion right before the light absorption layer 12 and then the undoped ~~undope~~ InP layer 13 is selectively wet-etched in this step. As [[this]] a result, a ridge part 18 in a inverse mesa shape is formed. Next, a first insulation layer 19 is formed at a groove at the side of the ridge part 18. A second insulation layer is formed so as to fill in the groove by a polyimide layer.

Please replace the paragraph beginning on page 9, line 5 with the following amended paragraph:

As shown in Fig.2D, after a chip is cleaved ~~cleavaged~~, a low reflection film 24 is coated on end faces where light of the waveguide type optical element enter/exit. Length of the waveguide type optical element is 50μm to 350μm in light propagation direction.

Please replace the paragraph beginning on page 9, line 11 with the following amended paragraph:

A feature of a method of manufacturing the waveguide type optical element of one embodiment in the present invention as described above is to selectively diffuse Zn on the light absorption layer 12 using the ~~undope~~ undoped InP layer 13. ~~Concetrately~~ Concretely, diffusion of Zn to the light absorption layer 12 from the p type InP clad layer 15 is suppressed at the side of the ridge part 18 and is ~~activity~~ actively performed at a portion under the ridge part by forming the ~~undope~~ undoped InP layer 13 on the light absorption layer 12 at the side of the ridge part 18.

Please replace the paragraph beginning on page 11, line 3 with the following amended paragraph:

A method of manufacturing an integrated optical waveguide type element using the waveguide type optical element of the first embodiment in the present invention, in particular, a method of manufacturing an integrated optical waveguide type element applied for an optical amplifier or an optical modulator, which integrates distribution feedback laser (DFB-LD) as the waveguide type optical element using the waveguide type optical element of the first embodiment in the present invention will be described referring to Figs.3A ~~to 3D, 5A, and~~ through 5B.

Please replace the paragraph beginning on page 11, line 13 with the following amended paragraph:

Figs.3A ~~to 3D, 5A, and~~ through 5B are sectional perspective views for explaining a method of manufacturing the integrated optical waveguide type element using the waveguide type optical element of the first embodiment in the present invention.

Please replace the paragraph beginning on page 11, line 27 with the following amended paragraph:

As shown in Fig.3C, a light absorption layer 36 and an ~~undope~~ undoped InP layer 37 are formed by crystal growth. An absorption layer structure is an MQW structure in a case where a QCSE is used. Thickness of the ~~undrope~~ undoped InP layer 37 is 10nm to 300nm.

Please replace the paragraph beginning on page 12, line 3 with the following amended paragraph:

As shown in Fig.4A, a part where the mask of the undoped ~~undope~~ InP layer 37 is not formed is selectively removed by etching. At this time, the absorption layer formed by quaternary ~~quaternany~~ mixed crystal is used as the etching stop layer.

Please replace the paragraph beginning on page 12, line 11 with the following amended paragraph:

As aforementioned above, when the light absorption layer 36 and the p type InP clad layer 39 are MOVPE grown, impurity is not added at a time where the light absorption layer 36 is grown and p type impurity is added at a time where the p type InP clad layer 39 is grown. Zn is chosen as a material added as p type impurity. At this time, amount to diffuse Zn on the light absorption layer 36 is controlled by controlling carrier density of Zn. Actually, the layers are grown at 600°C to 700°C in MOVPE growth. Time to grow the p type InP clad layer 15 depends on a growth speed. Usually, since the 1μm or more p type InP clad layer 15 is grown, growth of the p type InP clad layer 15 takes 20 minutes ~~minuitues~~ to 60 minutes ~~minuitues~~. Diffusion of Zn is determined by carrier density, temperature and time. A growth condition is controlled in order that Zn is diffused on the light absorption layer 36 by controlling those values. Amount to diffuse Zn is amount to diffuse Zn on a surface of the light absorption layer 36 and the p type InP clad layer 39. It is necessary to control amount to diffuse amount so that the light absorption layer 36 is not perforated.

Please replace the paragraph beginning on page 13, line 16 with the following amended paragraph:

As shown in Fig.5B, after a chip is cleaved ~~cleavaged~~, a low reflection film 49 is coated. Length of an activation area is 100μm to 550μm and a modulation area is

50μm to 350μm.

Please replace the paragraph beginning on page 13, line 20 with the following amended paragraph:

A feature of a method of manufacturing the waveguide type optical element of one embodiment in the present invention as described above is to selectively diffuse Zn on the light absorption layer using the undoped ~~undope~~ InP layer. Concretely ~~Concetrately~~, diffusion of Zn to the light absorption layer from the p type InP clad layer is suppressed at the side of the ridge part and is ~~activity~~ actively performed at a portion under the ridge part by forming the ~~undope~~ undoped InP layer on the light absorption layer at the side of the ridge part.

Please replace the paragraph beginning on page 13, line 30 with the following amended paragraph:

A feature to constitute the waveguide type optical element of the first embodiment in the present invention formed by the steps in Figs. 3A ~~to 3D, 5A and~~ through 5B is to have the light absorption layer formed on the compound semiconductor substrate, the ridge part formed at the predetermined part on the light absorption layer and the area to diffuse impurity made on the light absorption layer under the ridge part.

Please replace the paragraph beginning on page 15, line 21 with the following amended paragraph:

As shown in Fig.6A, a light absorption layer 52 and an undoped ~~undope~~ InP layer 53 are formed on an n type InP substrate 51 by crystal growth. A light absorption layer structure at this time is an MQW structure in a case where a QCSE is used. Thickness of the undrope InP layer 53 is 10nm to 300nm.

Please replace the paragraph beginning on page 15, line 31 with the following amended paragraph:

As shown in Fig.6C, a part where the mask of the undoped ~~undope~~ InP layer 53 is not formed is selectively removed by etching. At this time, an absorption layer formed by quaternary ~~quaternany~~ mixed crystal is used as an etching stop layer. To perform next selection growth, after the mask is once removed, the selection growth mask may newly be formed.

Please replace the paragraph beginning on page 16, line 9 with the following amended paragraph:

As aforementioned above, when the light absorption layer 52 and the p type InP clad layer 55 are MOVPE grown, impurity is not added at a time where the light absorption layer 52 is grown and p type impurity is added at a time where the p type InP clad layer 55 is grown. Zn is chosen as a material added as p type impurity. At this

time, amount to diffuse Zn on the light absorption layer 52 is controlled by controlling carrier density of Zn. Actually, the layers are grown at 600°C to 700°C in MOVPE growth. Time to grow the p type InP clad layer 55 depends on a growth speed. Usually, since the 1μm or more p type InP clad layer 55 is grown, growth of the p type InP clad layer 55 takes 20 minutes ~~minuitues~~ to 60 minutes ~~minuitues~~. Diffusion of Zn is determined by carrier density, temperature and time. A growth condition is controlled in order that Zn is diffused on the light absorption layer 52 by controlling those values. Amount to diffuse Zn is amount to diffuse Zn on a surface of the light absorption layer 52 and the p type InP clad layer 55. It is necessary to control amount to diffuse amount so that the light absorption layer 52 is not perforated.

Please replace the paragraph beginning on page 17, line 6 with the following amended paragraph:

As shown in Fig.7C, after a chip is cleaved ~~cleavaged~~, a low reflection film 62 is coated. Length of each area after the chip is formed is 50μm to 350μm.

Please replace the paragraph beginning on page 17, line 10 with the following amended paragraph:

A feature of a method of manufacturing the waveguide type optical element of the second embodiment in the present invention as described above is to selectively diffuse Zn on the light absorption layer using the ~~undope~~ undoped InP layer.

Concretely ~~Concetrately~~, diffusion of Zn to the light absorption layer from the p type InP clad layer is suppressed at the side of the ridge part and is ~~activity~~ actively performed at a portion under the ridge part by forming the ~~undope~~ undoped InP layer on the light absorption layer at the side of the ridge part.

Please replace the paragraph beginning on page 19, line 22 with the following amended paragraph:

As shown in Fig. 8C, a light absorption layer 76 and an ~~undope~~ undoped InP layer 77 are formed by crystal growth. An absorption layer structure at this time is an MQW structure in a case where a QCSE is used. Thickness of the ~~undrope~~ undoped InP layer 77 is 10nm to 300nm.

Please replace the paragraph beginning on page 19, line 32 with the following amended paragraph:

As shown in Fig.9A, a part where the mask of the ~~undope~~ undoped InP layer 77 is not formed is selectively removed by etching. At this time, the absorption layer formed by quaternary ~~quaternany~~ mixed crystal is used as an etching stop layer. To perform next selection growth, after the mask is once removed, the selection growth mask may newly be formed.

Please replace the paragraph beginning on page 19, line 32 with the following amended paragraph:

As shown in Fig.9B, a p type InP clad layer 79 and a p type InGaAs contact layer 80 are crystal-grown. At this time, ~~since this time~~[[,]] since a growth speed at a growth area is fast by a value of a mask interval and width, it is necessary to previously be suitable.

Please replace the paragraph beginning on page 20, line 11 with the following amended paragraph:

As aforementioned above, when the light absorption layer 76 and the p type InP clad layer 79 are MOVPE grown, impurity is not added at a time where the light absorption layer 76 is grown and p type impurity is added at a time where the p type InP clad layer 39 is grown. Zn is chosen as a material added as p type impurity. At this time, amount to diffuse Zn on the light absorption layer 76 is controlled by controlling carrier density of Zn. Actually, the layers are grown at 600°C to 700°C in MOVPE growth. Time to grow the p type InP clad layer 79 depends on a growth speed. Usually, since the 1μm or more p type InP clad layer 79 is grown, growth of the p type InP clad layer 79 takes 20 minutes ~~minuitues~~ to 60 minutes ~~minuitues~~. Diffusion of Zn is determined by carrier density, temperature and time. A growth condition is controlled in order that Zn is diffused on the light absorption layer 76 by controlling those values. Amount to diffuse Zn is amount to diffuse Zn on a surface of the light absorption layer

76 and the p type InP clad layer 79. It is necessary to control amount to diffuse amount so that the light absorption layer 76 is not perforated.

Please replace the paragraph beginning on page 21, line 9 with the following amended paragraph:

As shown in Fig.9E, after a chip is cleaved ~~cleavaged~~, a low reflection film 87 is coated. Length of an activation area after the chip is formed is 100μm to 550μm and a modulation area is 50μm to 350μm.

Please replace the paragraph beginning on page 21, line 14 with the following amended paragraph:

A feature of a method of manufacturing the integrated optical waveguide type element using the waveguide type optical element of the second embodiment in the present invention as described above is to selectively diffuse Zn on the light absorption layer using the ~~undope~~ undoped InP layer. ~~Concetrately~~ Concretely, diffusion of Zn to the light absorption layer from the p type InP clad layer is suppressed at the side of the ridge part and is ~~activity~~ actively performed at a portion under the ridge part by forming the ~~undope~~ undoped InP layer on the light absorption layer at the side of the ridge part.

Please replace the abstract with the following amended abstract:

~~According to the present invention, a feature of a waveguide type optical element and a~~ A method of manufacturing a waveguide type optical element wherein Zn ~~the same~~ is [[to]] selectively diffused ~~diffuse Zn~~ on a light absorption layer using an ~~undope~~ undoped InP layer. ~~Therefore, since~~ Since an impurity diffusion area is made on the light absorption layer under a ridge part, a depletion layer becomes thin in a thickness direction and an electric field can strongly be applied. Thereby, an extinction ratio characteristic of a device can be improved.